Timing of Aldicarb Applications to Control *Meloidogyne arenaria* in Peanut[1]

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ABSTRACT

Four field trials were conducted in northwest Florida to determine the efficacy of aldicarb applied at varying time intervals after planting on peanut (*Arachis hypogaea*) to manage the peanut root-knot nematode, *Meloidogyne arenaria*. Initial treatments with aldicarb (Temik 15G), fenamiphos (Nemacur 15G), and phorate (Thimet 15G) were made at planting of peanut cv. Southern Runner. The chemicals were applied as 20-cm-wide bands over the open seed furrow using a tractor-mounted Gandy applicator. Post-plant treatments were made with a Gandy applicator at time intervals from 28 to 104 d after planting as 36-cm-wide bands over the row centers. Post-harvest *M. arenaria* population densities were affected little by any chemical treatment compared to the control. The efficacy of the chemical treatments was variable and averaged only a 295-kg/ha yield increase for the single at-plant applications of aldicarb compared to the control. All at-plant + post-plant aldicarb treatments increased yield over the control by an average of 712 kg/ha. Results from these trials did not establish a single optimal time for post-plant application of aldicarb on peanut. Data from these tests, however, indicated that a post-plant aldicarb treatment can be applied latter than previously recommended in Florida.

Key Words: Application time, *Arachis hypogaea*, fenamiphos, phorate, Nemacur, root-knot nematode, Temik, Thimet.

In 1999, peanut (*Arachis hypogaea* L.) was grown on over 41,000 ha in Florida, representing a value of 61 million dollars (Anon., 2000). Plant-parasitic nematodes, primarily the peanut root-knot nematode, *Meloidogyne arenaria* (Neal) Chitwood, are major disease-causing problems in the crop (Dickson, 1985; Dunn and Dickson, 1997). Plant resistance to *M. arenaria* is not widely available in commercial cultivars of peanut. Thus, nematode management options are nematicides, crop rotation, or a combination of the two practices. Five nematicides are registered for use on peanut and include aldicarb, ethoprop, fenamiphos, vydate, and 1,3-dichloropropene (Dunn and Dickson, 1997). The most effacious nematicide is 1,3-dichloropropene, but application difficulties and excessive cost sometimes limit its use. Aldicarb is the most widely used nonfumigant nematicide because of its dual activity against *M. arenaria* and thrips (*Franklinella* spp.) in Florida peanut production. The recommended rate of aldicarb to manage *M. arenaria* is 1.68 kg ai/ha, with lower rates required for thrips control. The material is applied as an in-furrow or band treatment at planting and has resulted in significant peanut yield increases in some tests (Rodriguez-Kabana and King, 1985; Hagan and Weeks, 1998) but not in others (McGriff *et al.*, 1997; Koenning *et al.*, 1998). Additionally, aldicarb is registered under a 24c label in

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Florida for use at peg initiation as a band treatment of 1.68 kg ai/ha to enhance management activity of preplant and at-plant nematicide treatments. The aldicarb pegging time treatment at 35 d after planting peanut is a part of standard recommendations for management of *M. arenaria,* and yield increases to 500 kg/ha have been achieved by using this additional treatment (Dunn and Dickson, 1997). Post-plant aldicarb treatment has been accepted widely on peanut cultivars such as Florunner, however, little information is available on its use on a longer season cultivars or the efficacy of later season applications. The following tests were conducted to determine the comparative efficacy of aldicarb to manage *M. arenaria* when used later than currently recommended in the crop cycle.

Materials and Methods

Four field trials were conducted in northwest Florida in loamy sand soil (83% sand, 9% silt, 8% clay) infested with the peanut root-knot nematode, *M. arenaria*. Two of the sites were located at the Univ. of Florida North Florida Res. and Educ. Center (1993 - Test 1, 1996 – Test 4), and two were on the John King Farm (1994 - Test 2, 1995 - Test 3); all sites were near the town of Greenwood in Jackson County. Before planting, the plot areas were prepared by moldboard plowing and double discing. All plots were 6.1 m long and two rows wide placed on 0.91-m-wide centers, and treatments were replicated six times in a randomized complete block design.

Initial chemical applications were made at planting of peanut cv. Southern Runner on 21 May 1993, 19 May 1994, 23 May 1995 and 30 May 1996 in tests 1-4, respectively. Application of aldicarb 15G, fenamiphos 15G, and phorate 15G were made as a 20-cm-wide band over the open seed furrow with a tractor-mounted Gandy applicator. The phorate treatment served as the control and was applied to balance the activity of aldicarb and fenamiphos on thrips. Post-plant treatments were applied with a Gandy applicator at different time intervals after planting in a 36-cm-wide band over the row centers (Tables 1 and 2).

Soil samples from control plots were collected before planting each test to determine initial *M. arenaria* population densities. Six soil cores (2.5 cm diam.) to 25 cm deep were collected from each plot and composited. Nematodes were extracted from a 100 cm^3 subsample of soil from each plot, using the centrifugation-sugar flotation technique (Jenkins, 1964). Average initial population densities of *M. arenaria* second-stage juveniles were 127, 20, 105, and 45/100 cm^3 soil in tests 1-4, respectively. Post-harvest soil cores were collected and extracted from all tests and plots within 3 wk of peanut harvest.

Plants were observed for symptoms of phytotoxicity from chemical treatments. Peanuts were mechanically harvested on 8 Nov. 1993, 7 Nov. 1994, 19 Nov. 1995, and 24 Oct. 1996. Pods were force air-dried to 10% moisture, weighed, and yield converted to kg/ha.

Results

Test 1. Peanuts did not show phytotoxicity caused by nematicide treatment. Application of aldicarb at 84 and 103 d after planting improved pod yield ($P \leq 0.05$) compared to the control and other treatments which were not different (Table 1). Yield of the at-plant fenamiphos treatment was not different than the control. Post-harvest *M. arenaria* population densities did not differ among chemical treatments and the control. Com-

Table 1. Influence of post-plant timing treatments of aldicarb 15G on peanut pod yields and population densities of *Meloidogyne arenaria* in two field trials in northwest Florida, 1993 and 1994.[a]

Chemical	Rate	Days after planting[b]	Yield	Nematodes
	kg ai/ha		kg/ha	100 cm^3 soil
1993-Test 1				
Aldicarb 15G	1.68	104	3632 a[c]	451 ab
Aldicarb 15G	1.68	84	3461 a	410 ab
Fenamiphos 15G	2.81	0	3193 b	566 a
Aldicarb 15G	1.68	49	3125 b	406 ab
Aldicarb 15G	1.68	28	3081 b	193 b
Aldicarb 15G	1.68	0	3077 b	413 ab
Control (Phorate)	1.00	0	3069 b	274 ab
1994-Test 2				
Aldicarb 15G	1.68	28	3217 a	327 a
Aldicarb 15G	1.68	70	2948 ab	326 a
Aldicarb 15G	1.68	56	2674 abc	165 a
Aldicarb 15G	1.68	91	2603 abc	510 a
Fenamiphos 15G	2.24	0	2553 bc	379 a
Aldicarb 15G	1.68	0	2246 c	468 a
Control (Phorate)	1.00	0	2029 c	562 a

[a]A 20-cm-wide modified in-furrow treatment of aldicarb 15G (1.68 kg ai/ha) or fenamiphos 15G was made to all treatments at planting except for the control.

[b]Indicates number of days after planting for aldicarb 15G (1.68 kg ai/ha) application in a 36-cm-wide band over the plant row.

[c]Data are means of six replications; column means followed by the same letter are not significantly different ($P \leq 0.05$) according to Duncan's multiple range test.

Table 2. Influence of three post-plant timing treatments of aldicarb 15G on peanut pod yields and population densities of *Meloidogyne arenaria* in two field trials in northwest Florida, 1995 and 1996.[a]

Chemical	Rate	Days after planting[b]	Yield	Nematodes
	kg ai/ha		kg/ha	100 cm^3 soil
1995—Test 3				
Aldicarb 15G	1.68	56	1823 a	841 ab
Aldicarb 15G	1.68	28	1768 a	428 b
Aldicarb 15G	1.68	91	1736 a	1004 a
Aldicarb 15G	1.68	0	1723 a	542 ab
Aldicarb 15G	1.68	284[d]	1474 a	974 a
Fenamiphos 15G	2.24	0	1462 a	615 ab
Control (Phorate)	1.00	0	1021 b	503 b
1996—Test 4				
Aldicarb 15G	1.68	70	3022 a	585 c
Aldicarb 15G	1.68	28	3113 a	702 bc
Aldicarb 15G	1.68	49	2829 ab	1121 abc
Aldicarb 15G	1.68	284[d]	2778 ab	1356 a
Aldicarb 15G	1.68	91	2766 ab	634 bc
Aldicarb 15G	1.68	0	2441 b	1132 abc
Control (Phorate)	1.00	0	2187 b	1206 ab

[a]A 20-cm-wide modified in-furrow application of aldicarb 15G (1.68 kg ai/ha) was made to all treatments at planting except the control and 28 d aldicarb 15G treatment. These received phorate 15G (1.00 kg ai/ha) at planting.

[b]Indicates number of days after planting for aldicarb 15G application in 36-cm-wide band over the plant row.

[c]Data are means of six replications; column means followed by the same letter are not significantly different ($P \leq 0.05$).

[d]Only a post-plant application of aldicarb was made to this treatment and phorate (1.00 kg ai/ha) was applied at planting.

pared to the fenamiphos, lower population densities were found in the aldicarb treatment made 28 d after planting.

Test 2. Early to midseason growth was good in all plots, and phytotoxicity was not observed in any of the treatments. Later in the season, however, plants in two replications began dying from disease, primarily Cylindrocladium black rot caused by *Cylindrocladium crotalariae* (Loos) Bell & Sobers. Two replicates were subsequently discarded leaving only four replicates for data analysis. Applications of aldicarb at 28 and 70 d after planting improved yield ($P \leq 0.05$) compared to the control and the at-plant aldicarb treatment (Table 1). No differences in yield were observed among post-plant aldicarb treatments. Post-harvest *M. arenaria* population densities did not differ among treatments or the control.

Test 3. Phytotoxicity was not observed in any of the treatments, and all nematicide treatments increased yield over the control (Table 2). Both the single applications of aldicarb, either at-plant or post-plant, improved yields. Yields of peanut were low, reflecting high nematode population densities and lack of irrigation in the field. Post-harvest population densities of *M. arenaria* in the control treatment were lower than two of the aldicarb treatments.

Test 4. Early to midseason peanut growth was good in all plots, and phytotoxicity was not observed in any of the treatments. Application of Temik at 28 and 70 d improved yield compared to the control (Table 2). Yields of the former two treatments did not differ from the remaining post-plant aldicarb treatments. Post-harvest nematode population densities were lower in the highest yielding 70 d post-plant aldicarb treatment than in the control.

Discussion

Post-harvest *M. arenaria* population densities were affected little by any chemical treatment compared to the control. These data confirm the need for earlier sampling to determine differences in *M. arenaria* population densities among treatments (Dickson and Hewitt, 1988). In general, however, variations in nematode population densities within plots make it difficult to evaluate the direct effect of nematicides on nematode populations (Noe, 1990).

Efficacies of the chemical treatments were variable with little yield increase with the single at-plant applications of aldicarb or fenamiphos. Variability in yield responses with at-plant nonfumigant nematicide applications on peanut also have been found by other workers (Dickson and Hewlett, 1985; Koenning *et al.*, 1998). The at-plant application of aldicarb increased yields compared to the control in only two of the four tests while fenamiphos increased yields in two of three tests. All post-plant aldicarb treatments generally increased yield compared to the control and the single at-plant application of aldicarb or fenamiphos. Average yield increases with aldicarb over the control were at-plant treatment alone—295 kg/ha, at-plant plus 28 d post-plant treatment standard—718 kg/ha, and the remaining at-plant + post-plant treatments—707 kg/ha. Yield data from these trials, however, did not establish a single optimal time for post-plant application of aldicarb 15G on peanut. The variability in yield response at various application dates is similar to those data found by others for at-plant applications. These data indicate that post-plant applications may be made later than the normally recommended 35 d after planting (Dunn and Dickson, 1997) and can improve peanut yield when applied up to 104 d after planting on a late maturing peanut cultivar. However, the aldicarb 24c label requires a 90-d period between the last application and peanut harvest. The Southern Runner peanut cultivar used in this test matures in about 150-160 d, thus, aldicarb should not be applied later than 70 d after planting. Data from these tests indicate greater grower flexibility in timing of post-plant treatments than previously recommended.

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